University, and the amount will be increased eventually to something like 160,000*l.*; and the same university has also received from its class of '83 the sum of 20,000*l.* Princeton University has announced a gift of 50,000*l.* from Mrs. Russell Sage, and the University of Virginia received the same amount by the will of the late Mr. E. W. James. Mr. Andrew Carnegie has given 40,000*l.* to the Mechanics Institute of New York City and 20,000*l.* to Rochester University. The Hampden Agricultural School obtained 32,000*l.* by the will of the late Miss Alice Byington, and from that of the late Mr. Warren D. Potter the Massachusetts College of Pharmacy has benefited to the extent of 30,000*l.* The children of the late Rev. Orlando Harriman have presented 20,000*l.* to Columbia University, and Yale University has received 15,000*l.* by the will of the late Mr. G. B. Griggs. There would not appear to be any falling off in the enthusiasm shown for higher education by wealthy Americans, who continue to be fully alive to the need for well-endowed colleges throughout the States in order to fit American citizens to hold their own in the ever-increasing industrial competition.

LORD ROSEBERY opened the new engineering laboratories of the Heriot-Watt College, Edinburgh, on September 16, and delivered an inspiring address, in which he reviewed the history of the college and emphasised the value of technical training. After reminding the audience that Sir Walter Scott once said it was, in his opinion, as great a crime to hide knowledge from the people as it would be to hide the sun from them if we had the power, Lord Rosebery pointed out that the Heriot-Watt College was one of the first institutions founded in Great Britain for the express purpose of giving evening instruction to artisans, and it was the parent of all the mechanics' institutes and polytechnics that now are so rife and so much used throughout the country. It began by teaching only the principles of mechanics and chemistry and other branches of science of practical application to the several trades in Edinburgh. Now it works with the University, and gives what is practically extra-mural teaching, and while training in the evening classes corresponds to that given in the trade and commercial schools in Germany, the day college is doing the work which is done in the technical universities of Germany. Referring to the work of the day students, Lord Rosebery had something to say to employers of labour. If the number of day students could be multiplied, and if it were found possible for employers to give their apprentices days for study, besides the evenings that apprentices furnish for themselves, both the students and the employer would find their reward. If the college is ever to receive its full development, that fact will have to be recognised, and the number of day students will have to be greatly enlarged. Dealing with the training of specialists, the suggestion was made that the technical institutes in our great university towns should each specialise one side of their teaching to the extent that it would not be necessary to repeat it in other university towns, but that it could be carried to the highest pitch in each institute, and that each institute, being recognised by other local universities as regards the acceptance and reception of their students in these special branches, there would be an enormous advantage for the universities, and a vast economy of teaching power. "What a magnificent and inspiring sight is the contemplation of these thousands of students who utilise this college," said Lord Rosebery towards the end of his address. "They come, not forced, to education, as is the case in so many of our class of gentle birth, but after a day's hard work, determined, whatever their stress or fatigue may be, to utilise their evenings for the raising of their minds and the perfecting of their methods. There is no more encouraging symptom in any community than this, and if we can even contemplate the possibility of a nation in the main composed of such youths, the nation will have nothing to fear in the long run. It is on its honest and strenuous youth that every nation depends, and youth such as that, determined and resolute on its own perfection and its own efficiency, is the surest sign of the health and strength of a country."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 4.—"The Electrical Qualities of Porcelain, with Special Reference to Dielectric Losses." By Dr. H. F. **Haworth**. Communicated by Prof. W. E. Ayrton, F.R.S.

This research was undertaken to determine some of the electrical qualities of porcelain, and their variations with respect to potential, temperature, and time. The electrical properties investigated, and the results briefly stated, are as follows:—

A. Capacity Measurements.

(1) The rate of charge of a porcelain condenser.

The rate of charge is comparatively slow; practically the porcelain is fully charged in one minute, if we take the first galvanometer swing as a measure of the capacity.

(2) The charge of a porcelain condenser as a function of the potential.

For potentials up to 1200 volts the charge was directly proportional to the potential, if the potential changes were made slow enough.

(3) The influence of sudden cyclical changes of potential on the charge of a porcelain condenser.

If the potential changes were made rapidly the charge was not quite proportional to the potential. A lagging effect was shown, indicating a loss in the dielectric.

(4) The dielectric constant, measured after one minute's electrification, varied with the temperature according to the following laws:—

Between 0° and 30° C., $C_t = C_0 (1 + 0{\cdot}00223t + 0{\cdot}0005t^2)$.
Between 30° and 100° C., $C_{t_1} = C_{t_2} \cdot e^{0{\cdot}0264(t_1 - t_2)}$.

The dielectric constant at 20° C. was 8·95.

B. Conductivity Measurements.

(5) The apparent conductivity of porcelain, as measured by the ratio of current to potential, varies with the applied potential and the duration of the application. The dielectric polarises, or generates a back E.M.F., when a potential difference is applied to it. The conducting mechanism shows viscosity.

(6) The apparent conductivity of porcelain, measured after one minute's electrification, increases with the temperature according to the following law:—

$$\gamma_{t_1} = \gamma_{t_2} \cdot e^{0{\cdot}090\,37(t_1 - t_2)}.$$

The specific conductivity at 20° C. is $0{\cdot}2624 \times 10^{-13}$ mhos per centimetre cube.

C. Dielectric Loss Measurements.

(7) The dielectric loss varies as the 1·74th power of the applied voltage, and is independent of the time of the cycle.

The dielectric losses at high potentials, and reasonable frequencies, may be termed hysteretic (*i.e.* independent of the time of the cycle of electrification). At very slow frequencies the loss is mainly C^2R loss, and this shows viscosity effects; but these losses are swamped at working frequencies by the dielectric hysteresis.

The dielectric loss was measured by the difference of temperature which could be maintained by the central surface of the porcelain plate above atmospheric temperature. This temperature difference being only a few degrees, it follows from Newton's laws of cooling that the heat lost is proportional to this difference, and as the heat lost is equal to the heat gained, if the temperature is constant, a thermopile placed with one end in contact with the porcelain will generate an E.M.F. which is directly proportional to the dielectric loss. This E.M.F. was measured by connecting the thermopile to a low-resistance galvanometer, and noting the direct and reversed deflections to eliminate the effect of local E.M.F.'s, &c. The losses were first measured at constant frequency of fifty per second, with pressures up to 38,000 volts (R.M.S.), and were then determined at constant pressure, 30,000 volts R.M.S., and for frequencies between 15·8 and 200.

The results are summarised in the following formula :—

$$\left.\begin{array}{l}\text{Dielectric loss per}\\ \text{cubic centimetre}\\ \text{in time } t \text{ .. ..}\end{array}\right\} = 1{\cdot}83\times10^{-12}\ V^{1{\cdot}74}_{\text{R.M.S.}}(f+14{\cdot}4)t \text{ Joules},$$

where V is the R.M.S. potential gradient per centimetre and f is the number of cycles per second.

The results are illustrated with curves and tables, &c. A historical *résumé* is also given.

June 25.—"On the Atomic Weight of Chlorine." By Dr. Edward C. **Edgar.**

Three years ago Prof. Dixon and I published the results of nine direct determinations of the equivalent of chlorine. Our method was to burn a jet of hydrogen in an atmosphere of chlorine; and the number we obtained was appreciably higher than that approved by the International Committee on Atomic Weights. We found, however, when water was used to condense the hydrogen chloride formed in the flame, that some of the water vapour was decomposed by the free chlorine; so, in continuing the investigation, I avoided this by burning a jet of chlorine in *dry* hydrogen, condensing the hydrogen chloride as it was formed in a tube dipped into liquid air. In some of the experiments the hydrogen chloride formed has been weighed. My experiments (concluded in 1907) agree closely with the results previously obtained in 1905. The method employed was briefly as follows :—

A vacuous quartz combustion vessel was filled with hydrogen from a weighed palladium bulb. Chlorine was ignited by a spark at the tip of a quartz jet, and continued to burn in the atmosphere of hydrogen until nearly all the chlorine weighed had been burnt. The hydrogen chloride as it was formed in the flame condensed in a limb of the combustion vessel dipped into liquid air, and a little chlorine which had escaped burning also solidified. At the end of the combustion the residual gas was extracted by the pump and analysed; it proved to be practically pure hydrogen.

Then the hydrogen chloride was allowed to pass through a quartz tube filled with mercury vapour, where the chlorine it contained was completely removed, and the purified gas passed on to a steel bomb immersed in liquid air, where it was condensed in six experiments and successfully weighed in three. In two other experiments the hydrogen chloride was absorbed by water and weighed as aqueous acid.

In eight complete combustions about 15·5 grams of hydrogen were burnt. Taking the atomic weight of hydrogen as 1·00762, the direct ratio

$$\frac{\text{weight of chlorine burnt}}{\text{weight of hydrogen burnt}}$$

yielded the mean value $35{\cdot}462\pm0{\cdot}0008$ for the atomic weight of chlorine, while the ratio

$$\frac{\text{weight of hydrogen chloride caught}-\text{weight of hydrogen burnt}}{\text{weight of hydrogen burnt}}$$

gave $35{\cdot}461\pm0{\cdot}0009$ (mean value of five experiments).

The accepted value for chlorine, 35·45, is in process of revision by the International Committee this year.

"Further Note on a Luminous Glow generated by Electrostatic Induction in an Exhausted Vessel made of Silica." By F. J. **Jervis-Smith,** F.R.S.

A glow-bulb rotating within a cylindrical inductor, end dome-shaped, placed symmetrically, with respect to the axis of rotation of glow-bulb, exhibited glow and magnetic phenomena described already (Proc. Roy. Soc., January 30; NATURE, May 21, p. 71). Sir Oliver Lodge repeated some of the author's experiments with glass bulbs, and obtained the same effects. Bulbs similar in shape and size to those described, but of pure silica, were employed. The residual gas in silica glow-bulbs was air. The glow-bulb was supported 0·5 cm. from a disc-shaped terminal of an induction coil. Opposite the bulb a pointed terminal (negative) was placed, a brush discharge played over the bulb. Coil in action, bulb illuminated with brilliant emerald-green glow. Discharge stopped, glow continued, dying out in about fifteen minutes. This remarkable after-glow could be easily seen at a distance of 4 metres from the bulb. *Glass* bulbs do not exhibit this phenomenon.

A silica glow-bulb was mounted in the rotating apparatus already described. The inductor charged from about 1800 volts to 2000 volts. The silica glow-bulb gave out a glow unlike that of the glass bulbs. In experiments with glass bulbs the glow was not strong when the inductor was charged to about 1800 volts; also, magnetic phenomena could only be seen at a distance of 0·25 metre to 0·5 metre from the apparatus; but when a silica bulb, similar in size and exhaustion to the glass bulbs, was rotated, it could be seen without difficulty in the dark at a distance of 5 metres, and when the inductor was charged up to 3000 volts to 4000 volts it was clearly visible at 15 metres from the glow-bulb.

The magnetic phenomena are the same as those which exist when a glass glow-bulb is used.

A silica glow-bulb rotated in contact with dry mercury was negatively electrified, and exhibited a greenish glow. The potential on surface reached 1500 volts, and through an applied collector charged a Leyden jar. A mercury jet playing on a silica glow-bulb caused it to glow, and negative electricity was generated.

PARIS.

Academy of Sciences, September 14.—M. Bouchard in the chair.—Determination of the triple orthogonal systems comprising a family of Dupin cyclids, and, more generally, a family of surfaces with lines of curvature plane in the two systems: Gaston **Darboux.**—Some mixed forms of nuclear alterations: Joannes **Chatin.**—Observations of the comet 1908*c* made at the Observatory of Marseilles with the Eichens equatorial of 26 cm. aperture: M. **Borrelly.** Observations were made on September 3, 4, 6, 7, and 11, the positions of the comparison stars and apparent positions of the comet being determined. The comet is of the tenth magnitude.—Observations of the new comet 1908*c* made at the Observatory of Besançon with the bent equatorial: P. **Chofardet.** Similar observations for September 5.—The quadric of Lie: A. **Demoulin.**—Plane flight without motive power: Ernest **Esclangon.** Remarks on the recent notes by M. Marcel Deprez on the hovering flight of birds.—The liquid crystals of the ether salts of ergosterol: Paul **Gaubert.** The ethers of ergosterol present a liquid anisotropic phase, but with the propionate and acetate this phase is rather difficult to show, thus differing from the corresponding ethers of cholesterol.—The virulence of bacilli in relation to the course of pulmonary tuberculosis: A. **Rodet** and P. **Delanoë.** The virulence of the bacilli from a large number of tuberculous patients was tested by inoculation into rabbits and guinea-pigs. The experiments on the two animals do not lead to exactly parallel results; the two scales of virulence agree nearly absolutely at the extremes, but in the intermediate stages the concordance is not so good. There is a distinct relation between the virulence as shown by these experiments on animals and the course of the disease in the patients from whom the bacilli were derived. Predisposition of the tuberculous patient is not the only factor in determining the course of the disease; the virulence of the bacillus is also a determining factor.—The intra-dermo-reaction with tuberculin in animals: G. **Moussu** and Ch. **Mantoux.** The intra-dermo-reaction, if practised in the manner described, is absolutely without any effects on healthy animals; in the case of tuberculous animals there is no general thermal reaction and no interference with the general health, and the method appears to be very certain in its indications.—Some physiological properties of the muscles of invertebrates: Jan **Sosnowski.**

CALCUTTA.

Asiatic Society of Bengal, September 2.—A polyglot list of birds in Manchu, Chinese, and Turki, part ii.: Dr. E. D. **Ross.** In 1877–8 Robert Shaw published in the journal of this society a grammar and vocabulary of the Turki language. At the end of the vocabulary was printed a list containing upwards of 150 Turki names of birds with their identifications, prepared by Dr. Scully, who accom-

panied the second mission to Yarkand. The present paper forms the introduction to a memoir on the birds of Central Asia which is, in a manner, a supplement to Dr. Scully's list. The British Museum possesses a very valuable MS. in many volumes containing an exhaustive vocabulary in five languages, viz. Manchu, Mongolian, Tibetan, Turki, and Chinese, on every conceivable topic. The memoir, to which the present paper is an introduction, contains a transcript of the section on birds, omitting the Mongolian and Tibetan versions. Three hundred and fifty birds are enumerated. With the object of adding to the knowledge of the Turki language, and with the view of collecting and identifying as many Turki birds as possible, the writer has prepared an index containing not only all the bird names mentioned in the polyglot list and by Scully, but which further comprises all the bird names he has been able to find in Turki dictionaries and other works. The index contains 650 bird names, of which more than half have been more or less identified.—The retardation and acceleration in the dissolution of mercury in nitric acid, in the presence of minute traces of ferric nitrate and manganous nitrate: Prof. P. C. **Rây.**

CAPE TOWN.

Royal Society of South Africa, August 19.—Mr. S. Hough, F.R.S., president, in the chair.—The application of Doppler's principle to astrophysical problems: Dr. J. K. **Halm.** The importance of this principle in determining the motions of the celestial bodies in the line of sight by means of the displacements of the lines of their spectra from their normal positions was dealt with, and its application was illustrated by such examples as binary stars, Saturn's rings, the rotation of the sun, and the motion of the earth in its orbit round the sun.

NEW SOUTH WALES.

Royal Society, July 1.—Mr. W. M. Hamlet, president, in the chair.—Records of Australian botanists: (*a*) general, (*b*) New South Wales: J. H. **Maiden.** The author is endeavouring to do for Australian botanists what Britten and Boulger have done for British ones, and publishes many details concerning them for the first time. He omits references to living men, and also to the French botanists who did so much for Australia in the early years of settlement; he proposes to deal separately with these on some future occasion. The term "general" has been taken to include those botanists who have dealt with the plants of all the States or in more than one of them; the present paper gives a separate account of New South Wales botanists, and the author is making arrangements for the publication of the records of the botanists of the other States in those States.—The elastic substance occurring on the shoots and young leaves of *Eucalyptus corymbosa* and some species of Angophora: Henry G. **Smith.** The author records the results of a chemical investigation of this elastic substance, which is formed at the time the shoots are developed. As the buds expand, and the individual leaves are formed, the elastic coating stretches and expands with them. Changes then rapidly take place as the need of the protective coating is removed, and by light and oxidation a white powdery substance is formed, which remains on the surface of the leaves, and although no white coating can be detected upon the mature dull green leaves of this group of Eucalypts, yet it can readily be removed by ether with only five minutes' contact. A small quantity of a vegetable wax is formed at the same time, and this can be removed from the powdery substance by solution in boiling petroleum ether, and purified from boiling alcohol. As the genus Eucalyptus descends, and that group having white pulverulent young growth is reached, including such species as *E. cinerea, E. pulverulenta, E. globulus,* &c., then it is found that the wax has increased considerably in amount, and that the white appearance of these young leaves is due to the presence of a comparatively large amount of this wax, together with the white substance found on the leaves of the earlier members of the genus. The reason why the leaves of the "bloodwoods" (to which group *E. corymbosa* belongs) are not pulverulent is that there is a deficiency of the wax. In those species where the wax predominates, the elastic substance does not occur, the corresponding protective medium being supplied by the wax. The amount of material removed from the fresh young leaves of *E. corymbosa* by ether was equal to 0·84 per cent., of which 0·0224 per cent. was wax. From the fresh young leaves of *E. cinerea* the total removed was 1 per cent., of which 0·355 per cent. was wax. The elastic substance was found to be a very good form of caoutchouc, thus bringing the Myrtaceæ into those families of plants yielding this substance, and showing that both Eucalyptus and Angophora are "india-rubber" bearing plants. The best solvent was found to be chloroform, as the other usual solvents acted but little upon it. The sheet rubber obtained by the evaporation of the chloroform had great elasticity, did not melt below 250° C., and quickly regained its elasticity on cooling. In every other respect it acted as did crude commercial "rubbers." The rubber was also obtained from the plant by destroying the leaf substance by allowing the material to remain for five days in a 5 per cent. solution of potash, and removing the "rubber" by mechanical means. When heated in melted sulphur it vulcanised very well. If Eucalyptus "rubber" was obtained in quantity it would have considerable commercial value. This, however, from the natural plant is not possible, as the collection would be too costly, without considering the rapid alteration it undergoes on the leaf.

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